

See "Instructions for Filling out the Work Permit" contained in the Work Planning and Control for Experiments and Operations Subject Area.

1. Work request WCC fills out this section.

☐ Standing Work Permit

Requester: Don Lynch	Date: 06/28/2012	Ext.: 2253	Dept/Div/Group: PO/ PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 7/9/2012	Est. End Date: 10/31/2012
Brief Description of Work: Remove, troubleshoot, Repair, Upgrade and Re-install MPC North and South detector subsystems			
Building: 1008	Room: IR	Equipment: MPC N&S	Service Provider PHENIX Techs, MPC Experts

2. WCC, Requester/Designee, Service Provider, and ESS&H (as necessary) fill out this section or attach analysis

ESS&H ANALYSIS			
Radiation Concerns	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne
	<input type="checkbox"/> Contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> NORM
	<input type="checkbox"/> Other		
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group			
<input type="checkbox"/> Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer			
Radiation Generating Devices:	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges
	<input type="checkbox"/> X-ray Equipment		
Safety and Security Concerns	<input type="checkbox"/> None	<input type="checkbox"/> Explosives	<input type="checkbox"/> Transport of Haz/Rad Material
	<input type="checkbox"/> Pressurized Systems		
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Critical Lift	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Magnetic Fields*
<input type="checkbox"/> Railroad Work	<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Heat/Cold Stress
<input type="checkbox"/> Nanomaterials/particles*	<input type="checkbox"/> Rigging	<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical
<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Noise*	<input type="checkbox"/> Silica*	<input type="checkbox"/> Biohazard*
<input checked="" type="checkbox"/> Elevated Work	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Non-ionizing Radiation*	<input type="checkbox"/> Security Concerns
<input type="checkbox"/> Excavation	<input type="checkbox"/> Lead*	<input type="checkbox"/> Oxygen Deficiency*	<input type="checkbox"/> Suspect/Counterfeit Items
<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Ergonomics*	<input type="checkbox"/> Material Handling	<input type="checkbox"/> Penetrating Fire Walls
<input type="checkbox"/> Vacuum	* Safety Health Rep. Review Required		
<input type="checkbox"/> Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM	<input checked="" type="checkbox"/> Other Working near Be beampipe		
Environmental Concerns			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.		
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input type="checkbox"/> Land Use Institutional Controls	<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Liquid Discharges	<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Oil/PCB Management	<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Spill potential	<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping
Waste disposition by: <input type="checkbox"/> Other			
Pollution Prevention (P2)/Waste Minimization Opportunity:	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		
FACILITY CONCERNS			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Intermittent Energy Release		
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise	<input type="checkbox"/> Potential to Cause a False Alarm	<input type="checkbox"/> Vibrations
<input type="checkbox"/> Impacts Facility Use Agreement	<input type="checkbox"/> Temperature Change	<input type="checkbox"/> Other	
<input type="checkbox"/> Configuration Management	<input type="checkbox"/> Maintenance Work on Ventilation Systems	<input type="checkbox"/> Utility Interruptions	
WORK CONTROLS			
Work Practices			
<input type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input checked="" type="checkbox"/> Lockout/Tagout MMN & MMS	<input type="checkbox"/> Spill Containment
<input type="checkbox"/> Security (see Instruction Sheet)	<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs
<input type="checkbox"/> Time Limitation	<input type="checkbox"/> Other	<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey
<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")	<input type="checkbox"/> Electrical Inspection Required	
Personal Protective Equipment			
<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input type="checkbox"/> Gloves	<input type="checkbox"/> Lab Coat
<input checked="" type="checkbox"/> Safety Glasses	<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles
<input type="checkbox"/> Respirator*	<input type="checkbox"/> Safety Harness	<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield
<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers	<input checked="" type="checkbox"/> Safety Shoes	<input type="checkbox"/> High visibility cloths/vest
<input type="checkbox"/> Other			
Permits Required (Permits must be valid when job is scheduled.)			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems	
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No	
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other	
Dosimetry/Monitoring			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input type="checkbox"/> TLD
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O ₂ /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump	
Training Requirements (List specific training requirements)			
CA Access, PHENIX Awareness, Working at Heights, Fall protection			
Based on analysis above, the Review Team determines the risk, complexity, and coordination ratings below:		If using the permit when all hazard ratings are low, only the following need to sign: (Although allowed, there is no need to use back of form)	
ESS&H Risk Level:	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High	WCC:	Date:
Complexity Level:	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High	Service Provider:	Date:
Work Coordination:	<input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High	Authorization to start	Date:
(Department/Division, or their equivalent, Sup/WCC/Designee)			

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)**Work Plan** (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail):

See Attached Procedure

Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring)
None

Notifications to operations and Operational Limits Requirements: None

Post Work Testing, Notification or Documentation Required: MPC Commissioning tests

Job Safety Analysis Required: ☐ Yes ☒ NoReview Done: ☒ in series ☐ team**Reviewed by:** * Primary Reviewer signature means that the Review Team members were appropriate for the work that was planned, the Team visited the job site, hazards and risks that could impact ESS&H have been considered and controls established according to BNL requirements. In addition, this signature indicates that applicable JRAs, FRAs, as well as other planning documents have been reviewed and training requirements have been identified and recorded on this permit.

Title	Name (print)	Signature	Life #	Date
ES&H Professional				
F&O Facility Project Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Safety Health Representative				
Research Space Manager				
Other				
Other (PHENIX Escort)				
Required Walkdown Completed				
*Primary Reviewer				

4. Job site personnel (Supervisor and workers) fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments) and all training required for this permit is current/complete. Job Supervisor/Contractor Supervisor signatures also includes verification that worker training required for this permit is current/complete.

Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:

Workers are encouraged to provide feedback on ESS&H concerns or on ideas for improved job work flow. Use feedback form or space below.

5. Department/Division, or their equivalent, Line Manager or Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)

Name:	Signature:	Life#:	Date:
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6. Worker provides feedback.**Worker Feedback (use attached sheets as necessary)**a) WCM/WCC: Are there any changes as a result of worker feedback? ☐ Yes ☐ No

Note: See Work Planning and Control for Experiments and Operations Subject Area section 2.6.

7. Post Job Review/Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of job site to work supervisor.) The WCC ensures that the change process to update drawings, placards, postings, procedures, etc., is initiated, if necessary.

Name:	Signature:	Life#:	Date:
Comments:			

**MPC South and North Detector Subsystems, Removal and Reinstallation
PHENIX IR, Bldg. 1008**

Discussion

During run 12 both the north and south MPC internal electronics experienced a damaging beam abort event that disabled a large fraction of the MPC modules. MPC experts have determined that the damaged components can not be repaired in situ. Consequently the MPC modules must be removed and repaired in the PHENIX electronics shop and/or at an external vendor. Additional steps are anticipated to provide protection against similar future events.

Note: Prior to commencing the removal of the MPC subsystems, a suitable temporary staging area shall be setup in the PHENIX electronics tech shop to store the MPC modules after they are removed from the IR. In this staging area MPC electronics shall be diagnosed for faults, routed to the appropriate location for repair/upgrade, returned when completed and reassembled, ready for re-installation.

Caution: During all phases of the work described herein, maintain extreme care at all times to prevent contact with the beam pipe.

Procedures

A. Removal of North MPC

1. LOTO the power to the MMN magnet coil at the power supply in 1008B.
2. Assure that the CM is locked in its southern most position by locking out the hydraulics to each magnet mover.
3. Assure that all power to the detector is locked out.

Note: Only PHENIX technicians fully trained and approved for this operation by the cognizant engineers and technical supervisor may operate the articulated arm man lift. A maximum of 2 people may perform the following work in the manlift bucket and a third person shall be in the PHENIX IR, aware of the work being performed, and within communication distance at all times. The passenger in the manlift shall be fully trained as indicated above and shall be approved for this work by the cognizant engineers and technical supervisor.

4. Using the articulated arm manlift, carefully driven to avoid any possibility of contact with adjacent detector components or the beampipe to access the MMS piston cavity, carefully detach the signal and power cables, move the detached cables away from the piston hole and secure them so that they will not interfere

with beampipe installation or be exposed to damage during beampipe installation operations.

5. Remove the electronics cards and front panels from each of the sextants,
6. Remove the individual modules from each sextant and carefully stow them for reassembly.
7. Disassemble the individual sextants in reverse order indicated in the attached MPC North Installation Plan.
8. As sextants are removed, transport them to the MPC temporary staging area in the PHENIX electronics assembly room and reassemble the individual modules into the sextants to store until ready for reinstallation in the piston hole.

B. Removal of South MPC

1. LOTO the power to the MMS magnet coil (if not already locked out) at the power supply in 1008B.
2. Assure that the CM is locked in its northern most position by locking out the hydraulics to each magnet mover.
3. Assure that all power to the detector is locked out

Note: The MPC South shall be disassembled and re-assembled from temporary scaffolding installed for the purpose of servicing/upgrading the MuTr South detector. Alternatively, if desired, the scaffolding may be removed and the manlift operation described in A., above, may be utilized.

4. From the scaffolding, carefully detach the signal and power cables, move the detached cables away from the piston hole and secure them so that they will not interfere with other operations or be exposed to damage during the time the MPC South is out.
5. Disassemble the individual octants in reverse order indicated in the attached MPC South Installation Plan. (Note: individual modules within the octants may be removed first or may be removed intact in the octants at the discretion of the MPC engineer/scientist/technician overseeing the operation.)

As octants are removed, transport them to the MPC temporary staging area in the PHENIX electronics assembly room.

C. Reinstallation of South MPC

1. After repairs/upgrades have been completed and the MPC South re-assembled, LOTO the power to the MMS magnet coil (if not already locked out) at the power supply in 1008B.
2. Assure that the CM is locked in its northern most position by locking out the hydraulics to each magnet mover.
3. Assure that all power to the detector is locked out

Note: The MPC South shall be re-assembled from temporary scaffolding installed for the purpose of servicing/upgrading the MuTr South detector. Alternatively, if desired, the scaffolding may be removed and the manlift operation described in A., above, may be utilized.

4. Retrieve the 8 octant sections of the MPC South from the temporary staging area in the PHENIX electronics assembly room.
5. Using the articulated arm manlift, carefully driven to avoid any possibility of contact with adjacent detector components or the beampipe to access the MMS piston cavity, carefully install the 8 octants. (Note: individual octants may be installed intact with all individual modules pre-installed or as empty octants and the individual modules and front covers installed after all 8 empty octants have been installed at the discretion of the MPC engineer/scientist/technician overseeing the operation. (See the MPC South Installation Plan, attached.) Refer to the MPC North Installation Plan, attached, for details.)
6. Connect front end electronics, power and signal cables, etc.
7. Align and position the MPC as desired.
8. Test, commission and verify operation of all MPC South components.

D. Reinstallation of North MPC

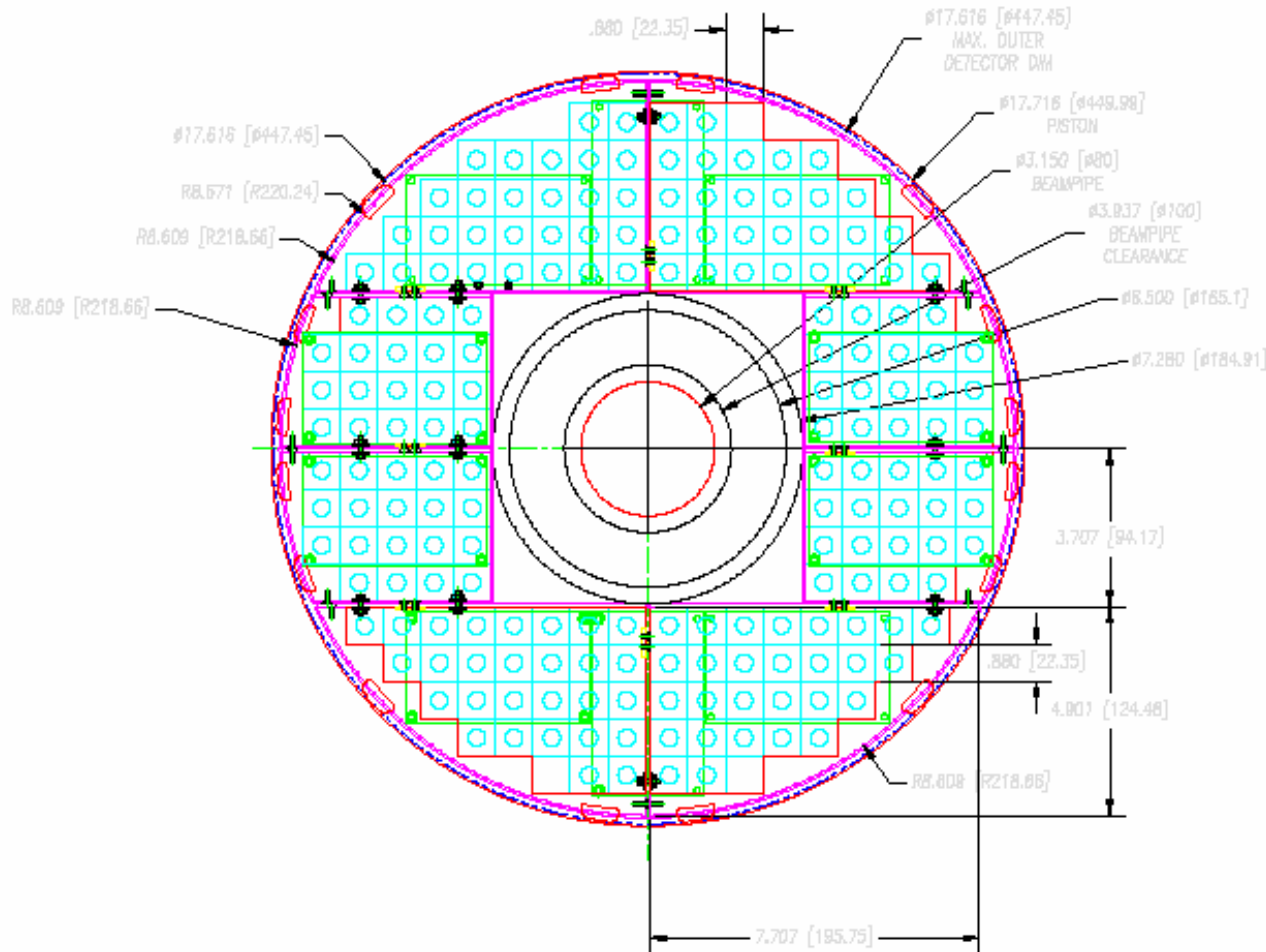
1. After repairs/upgrades have been completed and the MPC North re-assembled, LOTO the power to the MMN magnet coil (if not already locked out) at the power supply in 1008B.
2. Assure that the CM is locked in its southern most position by locking out the hydraulics to each magnet mover.
3. Assure that all power to the detector is locked out

Note: Only PHENIX technicians fully trained and approved for this operation by the cognizant engineers and technical supervisor may operate the articulated arm man lift. A maximum of 2 people may perform the following work in the manlift bucket and a third person shall be in the PHENIX IR, aware of the work being performed, and within communication distance at all times. The passenger in the manlift shall be fully trained as indicated above and shall be approved for this work by the cognizant engineers and technical supervisor.

4. Retrieve the 6 sextant sections of the MPC North from the temporary staging area in the PHENIX electronics assembly room.
5. Using the articulated arm manlift, carefully driven to avoid any possibility of contact with adjacent detector components or the beampipe to access the MMS piston cavity, carefully install the 6 sextants. The north sextants are installed and aligned empty, after which the individual modules are assembled and cabled. Front covers are then attached.
6. Connect front end electronics, power and signal cables, etc.
7. Align and position the MPC as desired.
8. Test, commission and verify operation of all MPC North components.

MPC South Installation Plan

MPC Installation

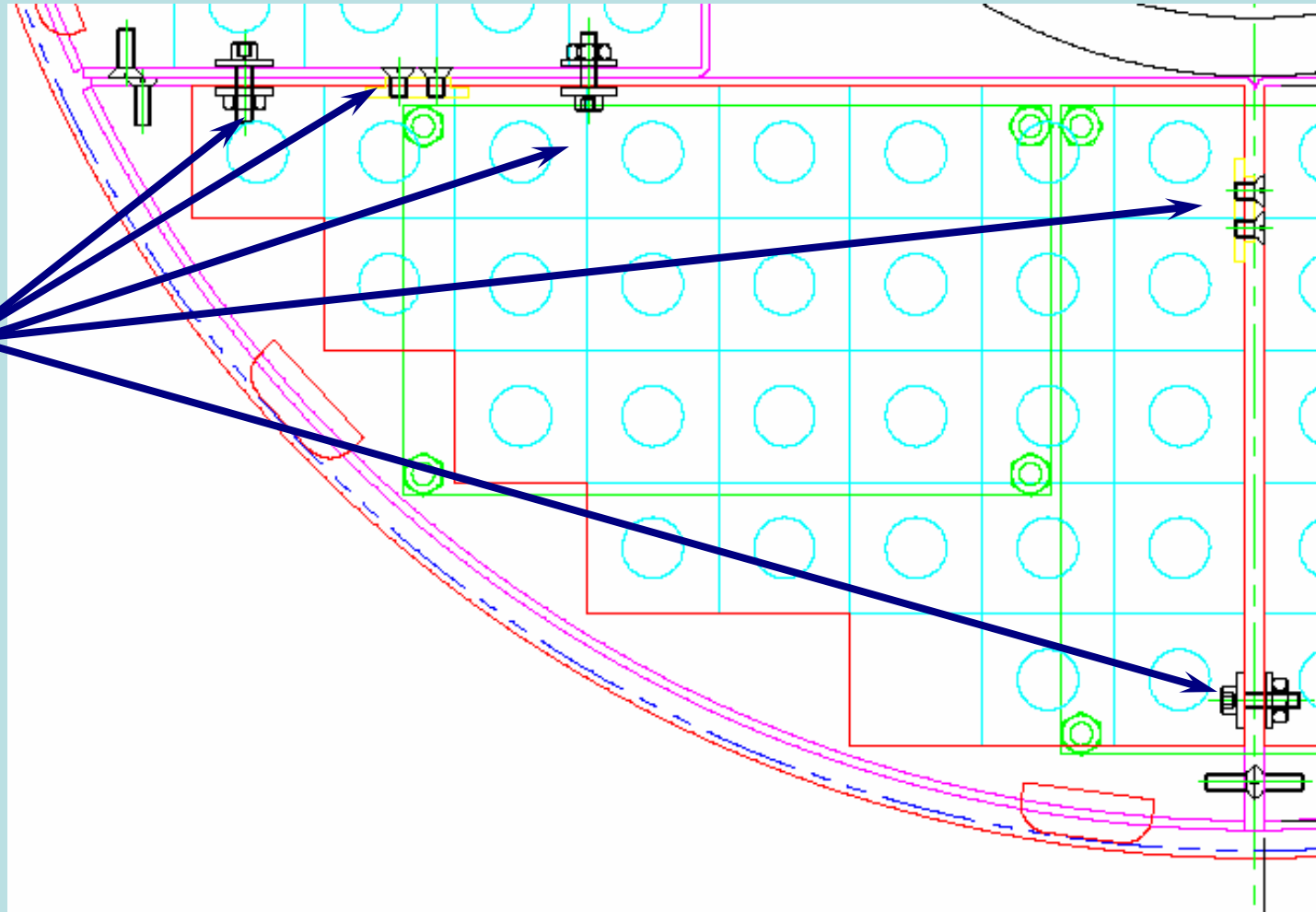


8 modules:

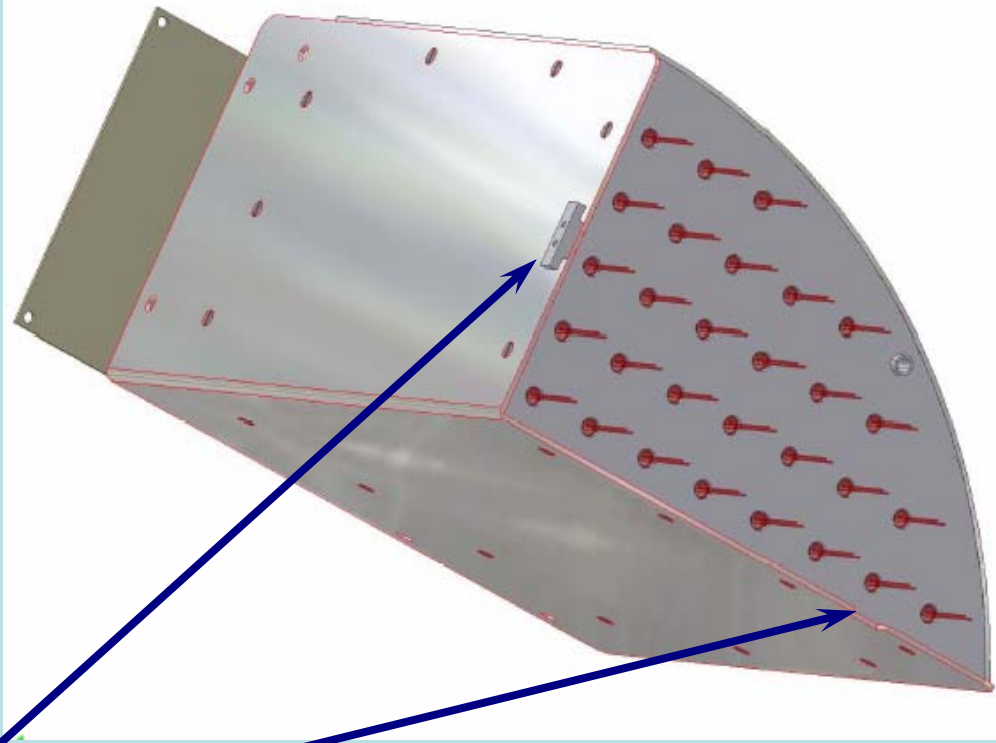
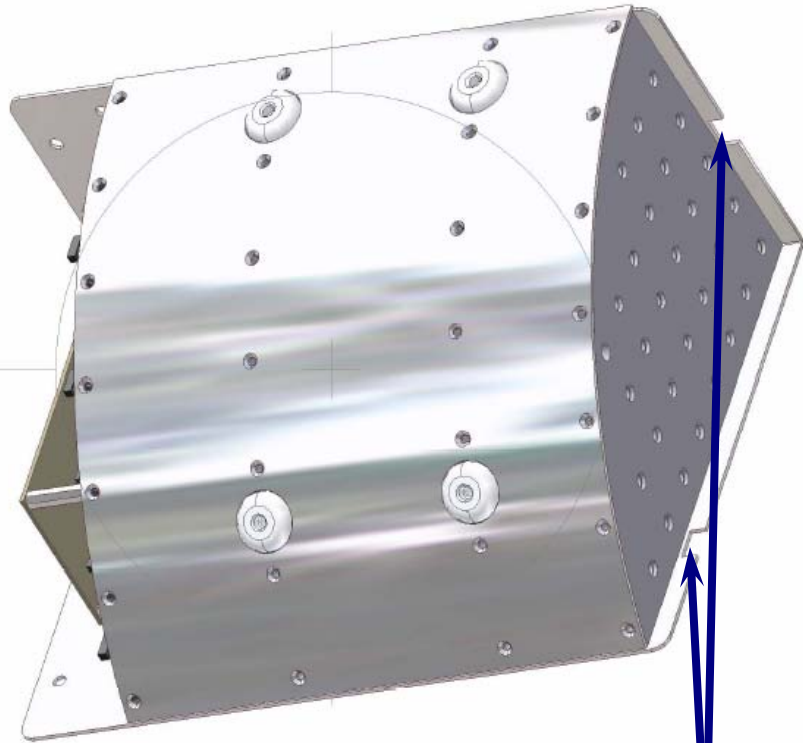
- 4 wedges w/ 29 crystals each
- 4 bricks w/18 crystals each
- 188 crystals total

MPC Installation

Modules are attached to adjacent modules with tab/slots at rear and screws at front

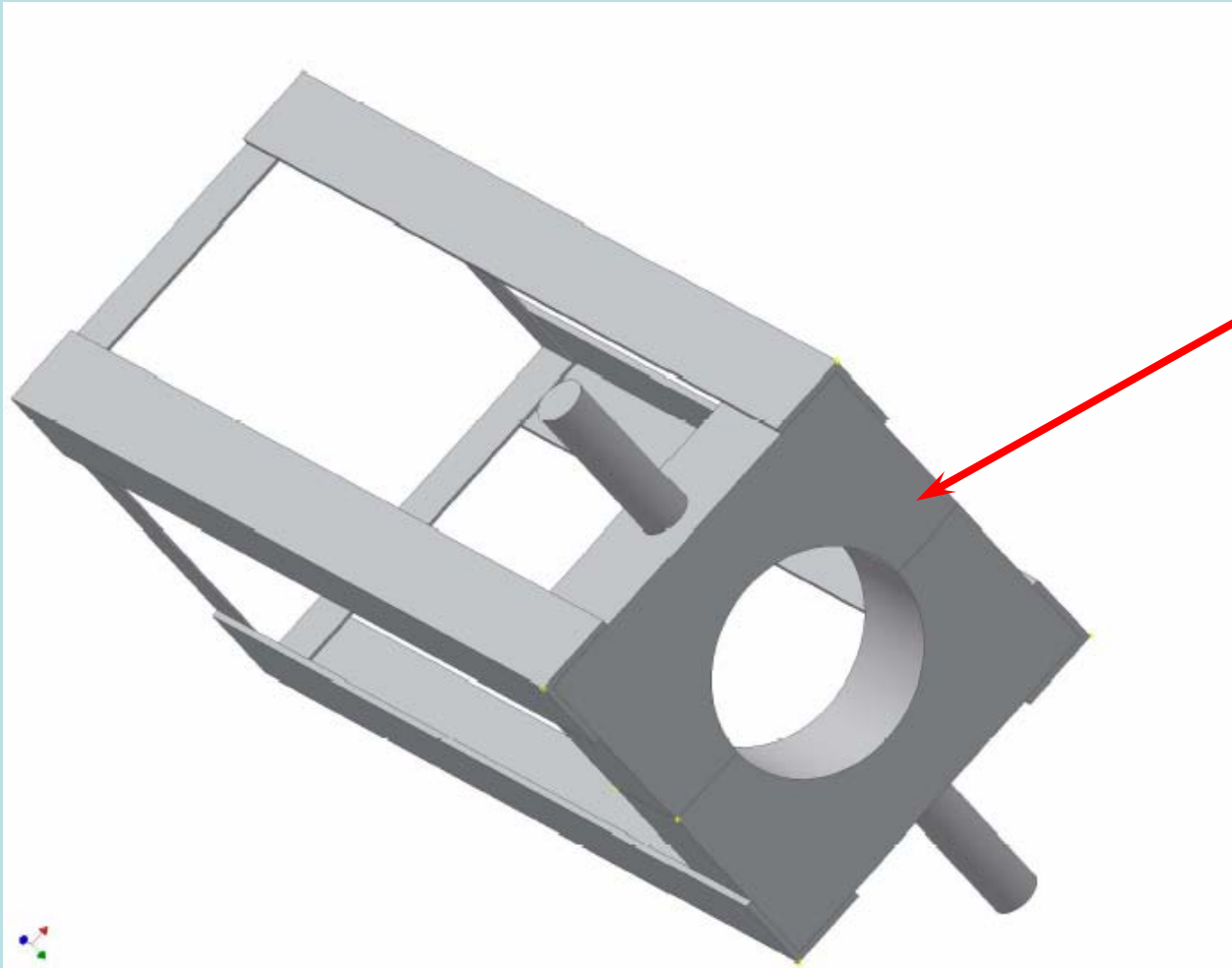


MPC Installation



Locking Tabs at rear of modules

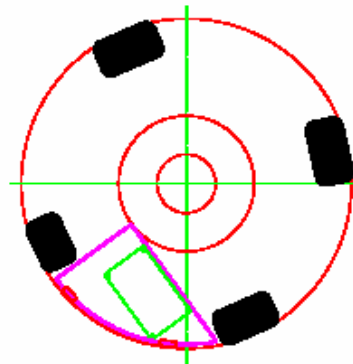
MPC Installation



**MPC Installation
Tool**

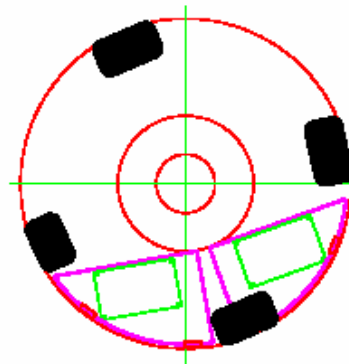
MPC Installation

1. Insert lower-west wedge module



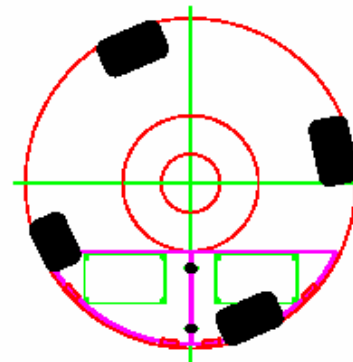
STEP 1

2. Rotate lower-west wedge module counter-clockwise, insert lower-east module



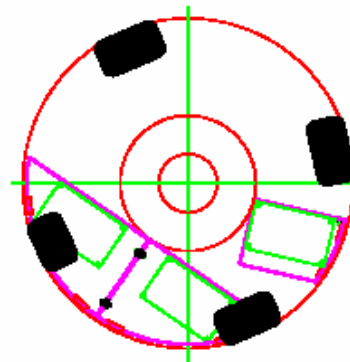
STEP 2

3. Rotate lower wedge modules to normal position



STEP 3

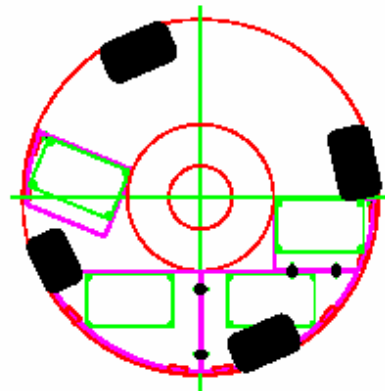
4. Rotate lower wedge modules clockwise, insert below-center west block module



STEP 4

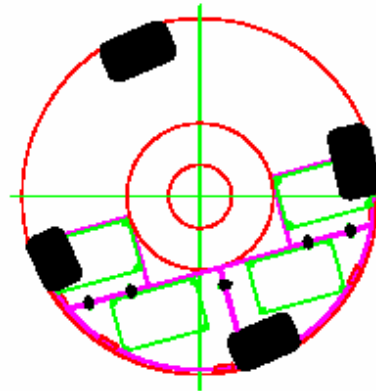
MPC Installation

5. Rotate modules back to normal position. Insert below-center east block module



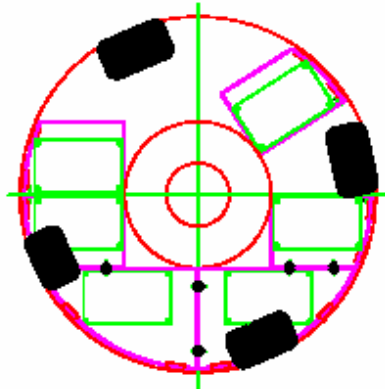
STEP 5

6. Rotate modules counter-clockwise, insert above-center east block module



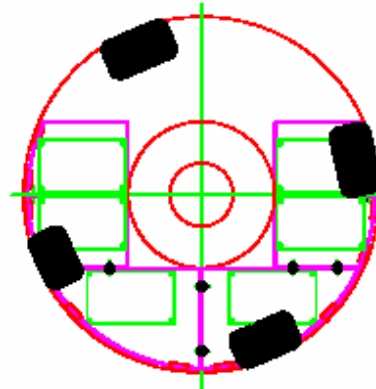
STEP 6

7. Rotate modules to normal position. Insert above-center West block module



STEP 7

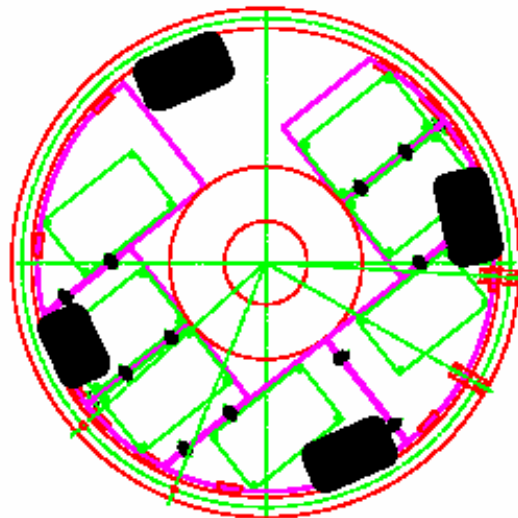
8. Ready for upper wedge modules



STEP 8

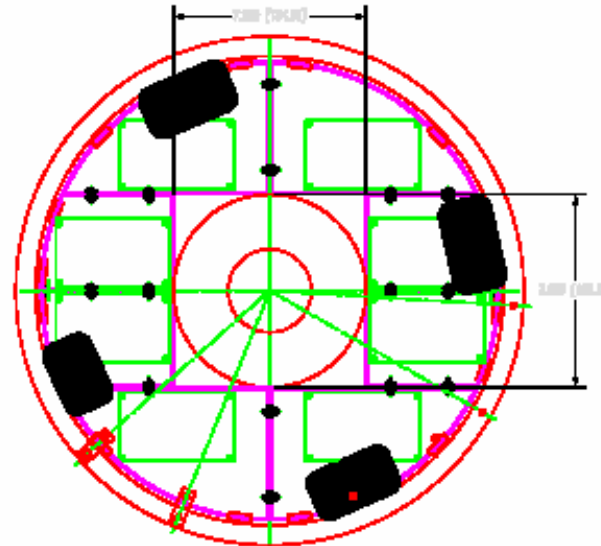
MPC Installation

9. Rotate modules counter-clockwise. Insert upper east wedge



STEP 9

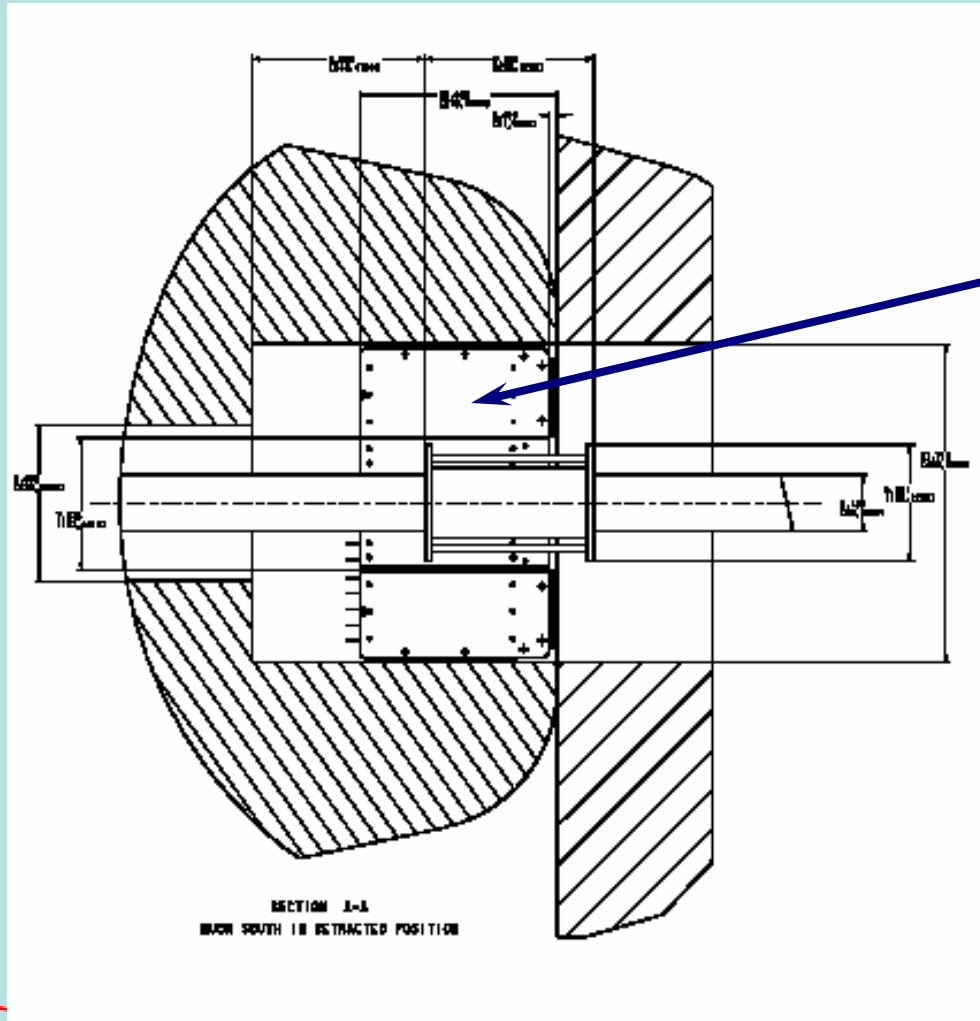
10. Rotate modules clockwise, to normal position. Insert upper-west wedge module



STEP 10

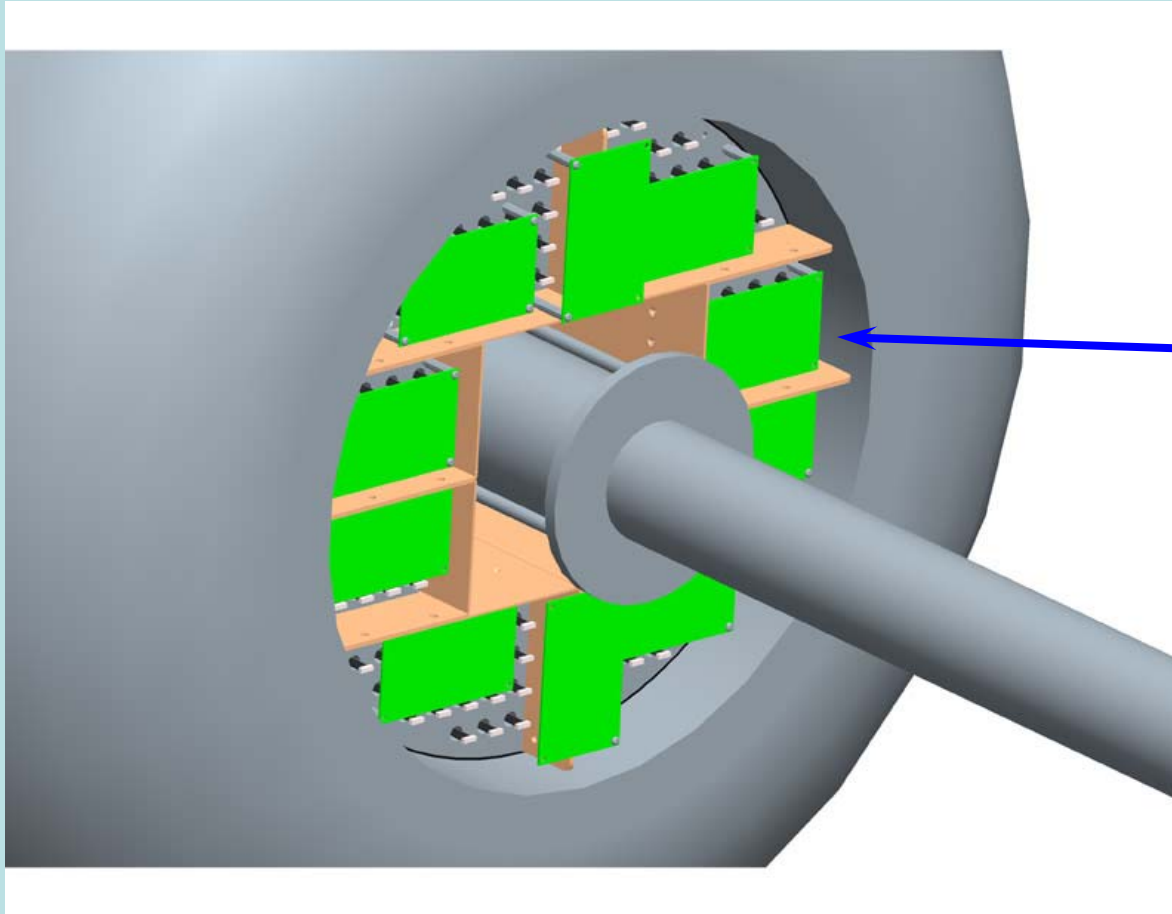
11. Connect cables and gas lines, push assembly to back wall of cavity align and lock in position

MPC Installation



**MPC after all
modules are
installed, before
moving back in
cavity and
before being
cabled**

MPC Installation

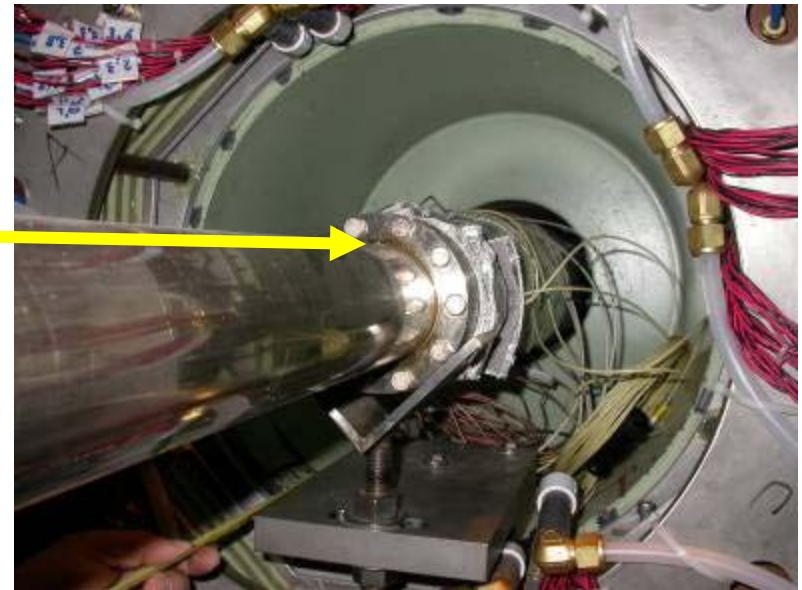
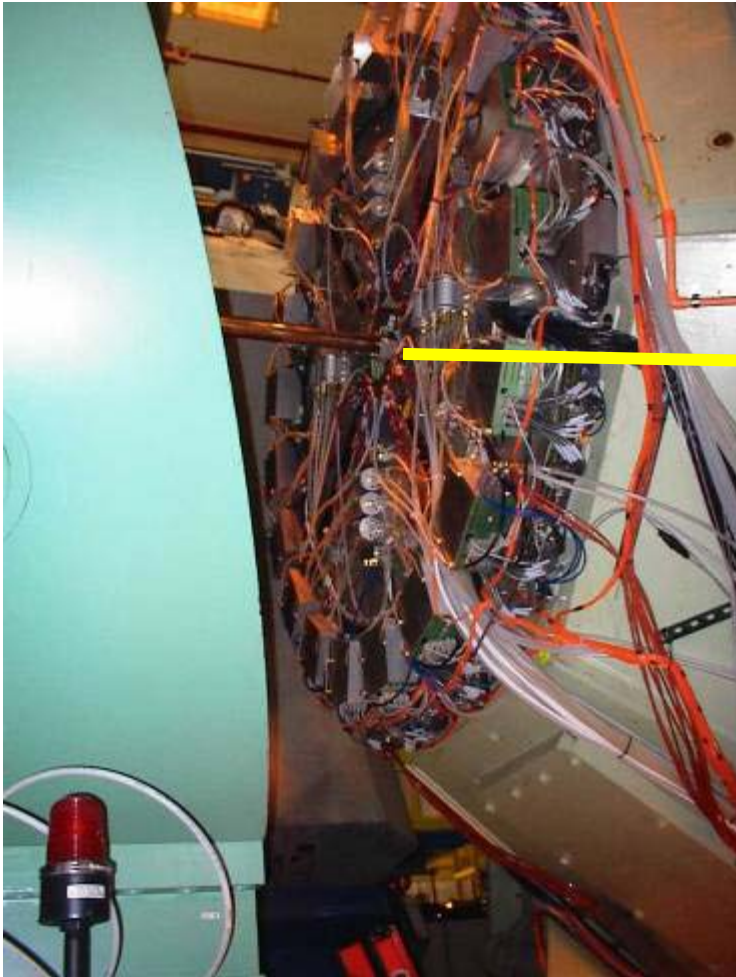


MPC after all
modules are
installed, before
moving back in
cavity and
before being
cabled

(MuTr Station 1
omitted for
clarity)

MPC North Installation Plan

MPC North will be installed in the Muon Magnet North piston cavity

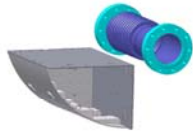


July 24, 2006

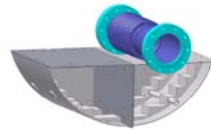
MPC North Assembly



**MPC North to be installed from
man lift, as South version was.**



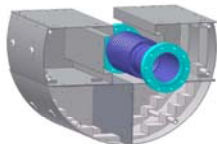
1



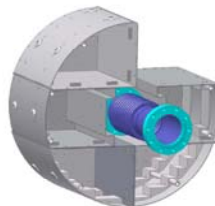
2



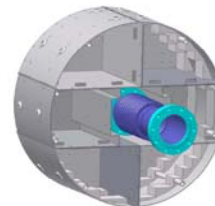
3



4



5



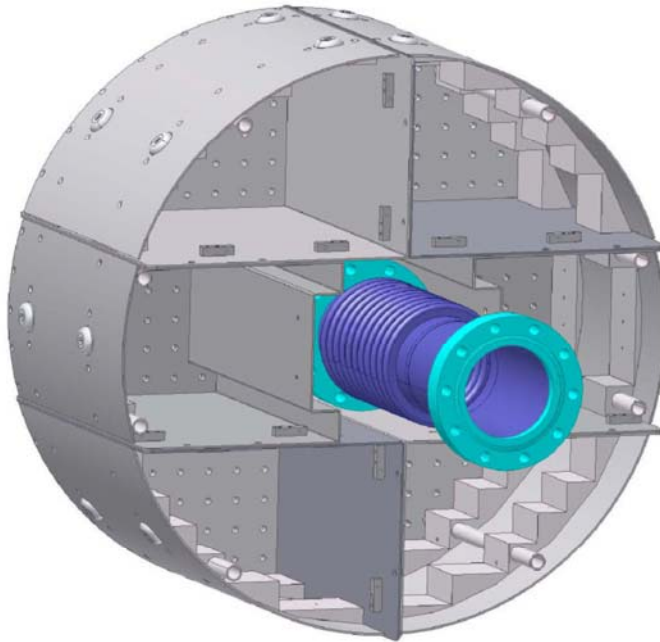
6

Empty sextants are installed first. LED's and LED board are already attached.

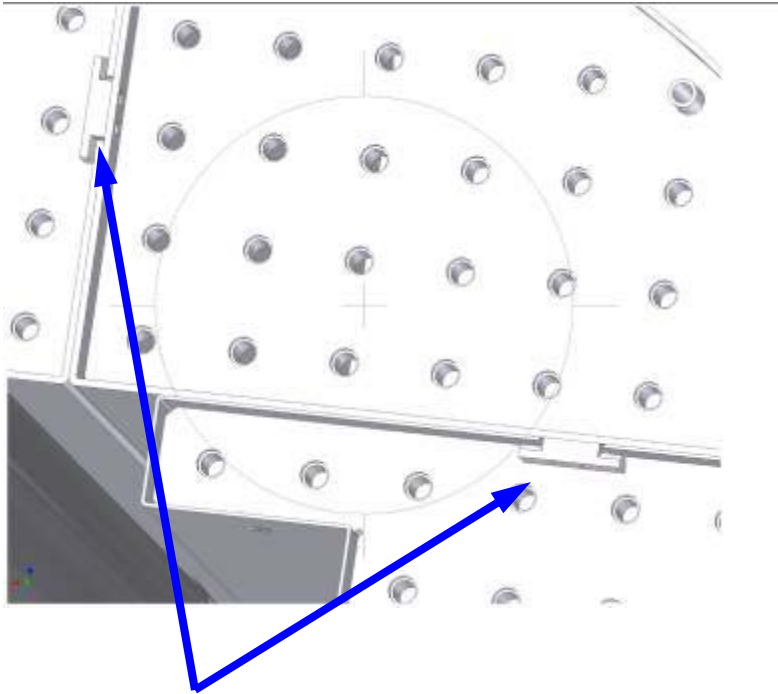
Then modules are individually inserted.

Next APD cable is attached then snaked through cover which is attached.

Finally, standoffs and signal pcbs are attached, wired and routed to MPC N rack.

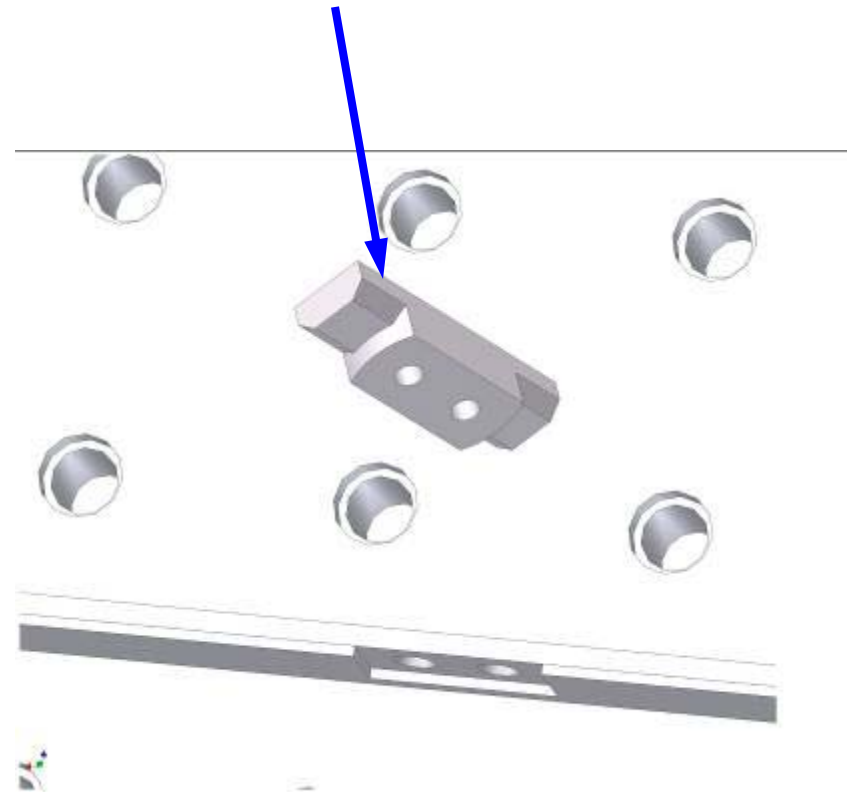


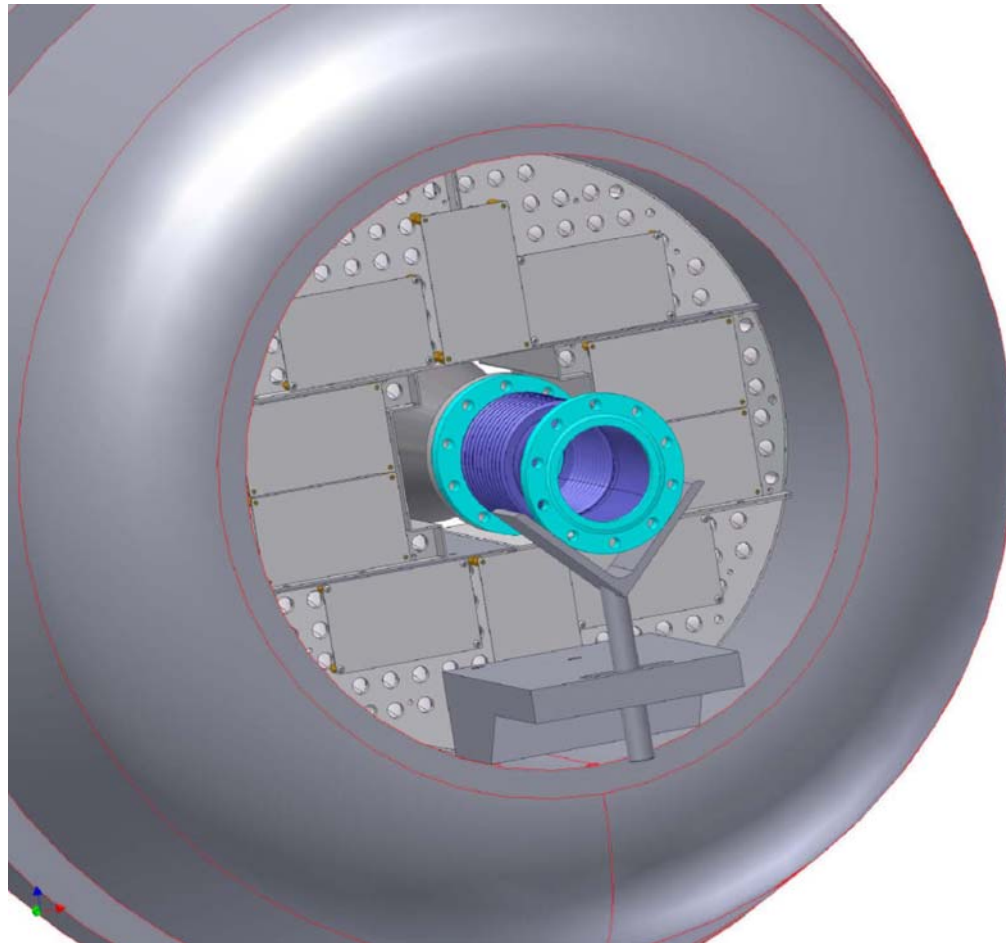
All of the
empty sectors
are installed
before the
crystals are
inserted



Modules interconnect at rear using tabs as in MPC S

Tabs for MPC N modified for increase clearance and rounded for easy locating and self centering





**MPC North mechanical
assembly complete
ready for cabling**

MPC North Cable Routing



Location for MPC N rack
(side of MuID rack)

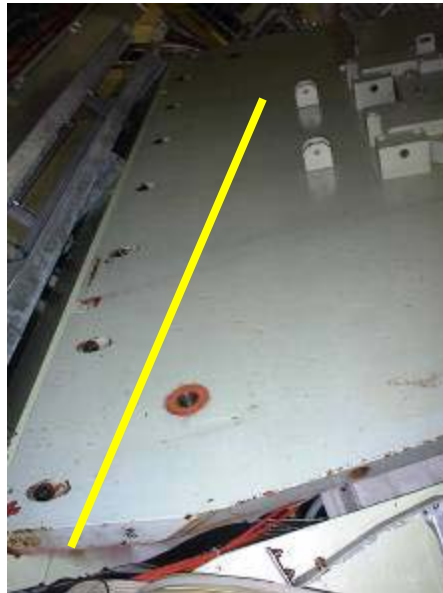
Need to relocate this cable tray

MPC North Cable Routing

1



2



3



4



1. From MuID rack to NMM
2. Up NMM vertical I/shade
3. Over top of NMM to center, then down
4. Under scaffold platform
5. down top lampshade (like MPC S)

5



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MPC North Assembly